

INV. TITLE: FULLY ARTICULATED AND COMPREHENSIVE AIR AND FLUID DISTRIBUTION, METERING, AND CONTROL METHOD AND APPARATUS FOR PRIMARY MOVERS, HEAT EXCHANGERS, AND TERMINAL FLOW DEVICES.

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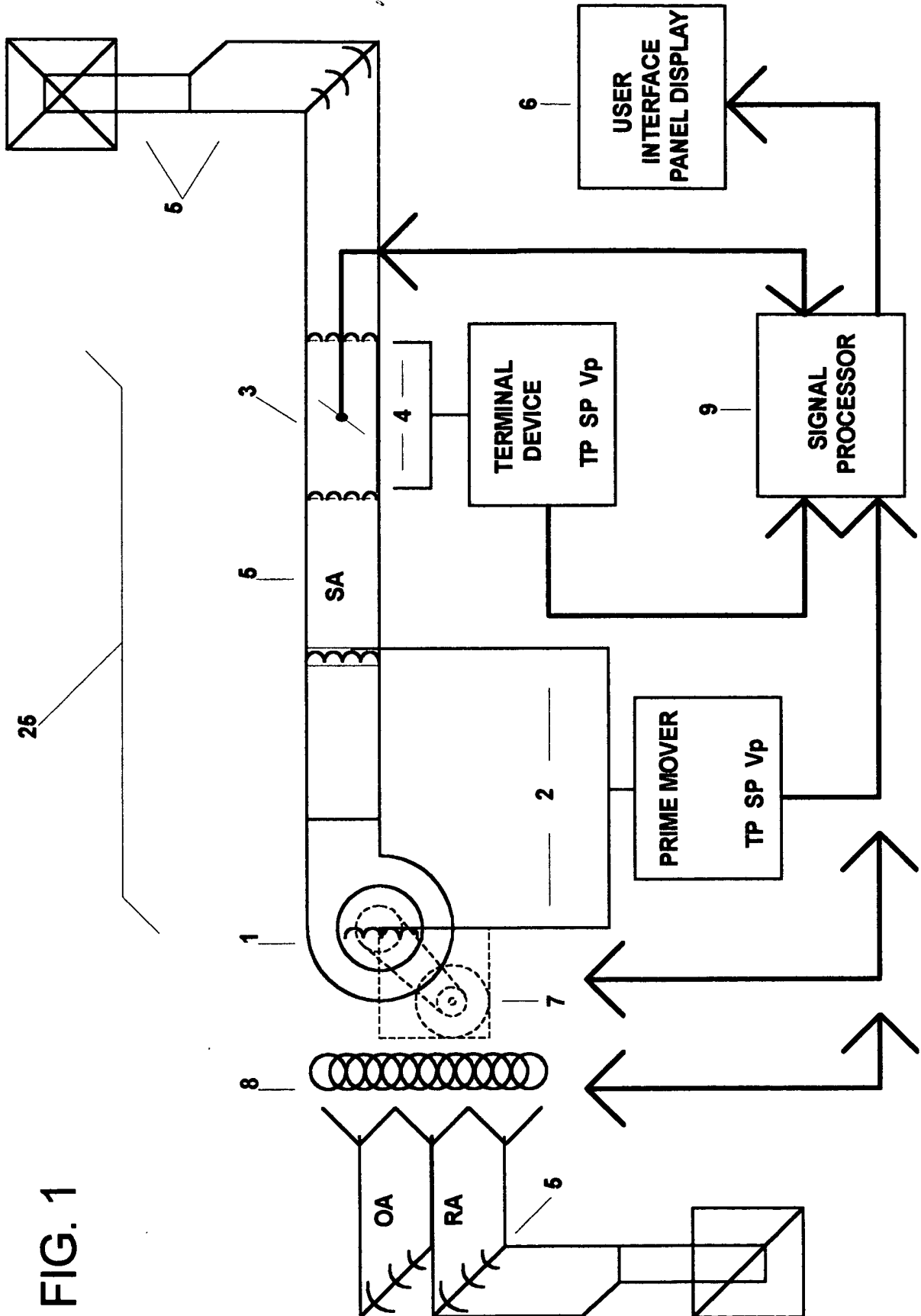
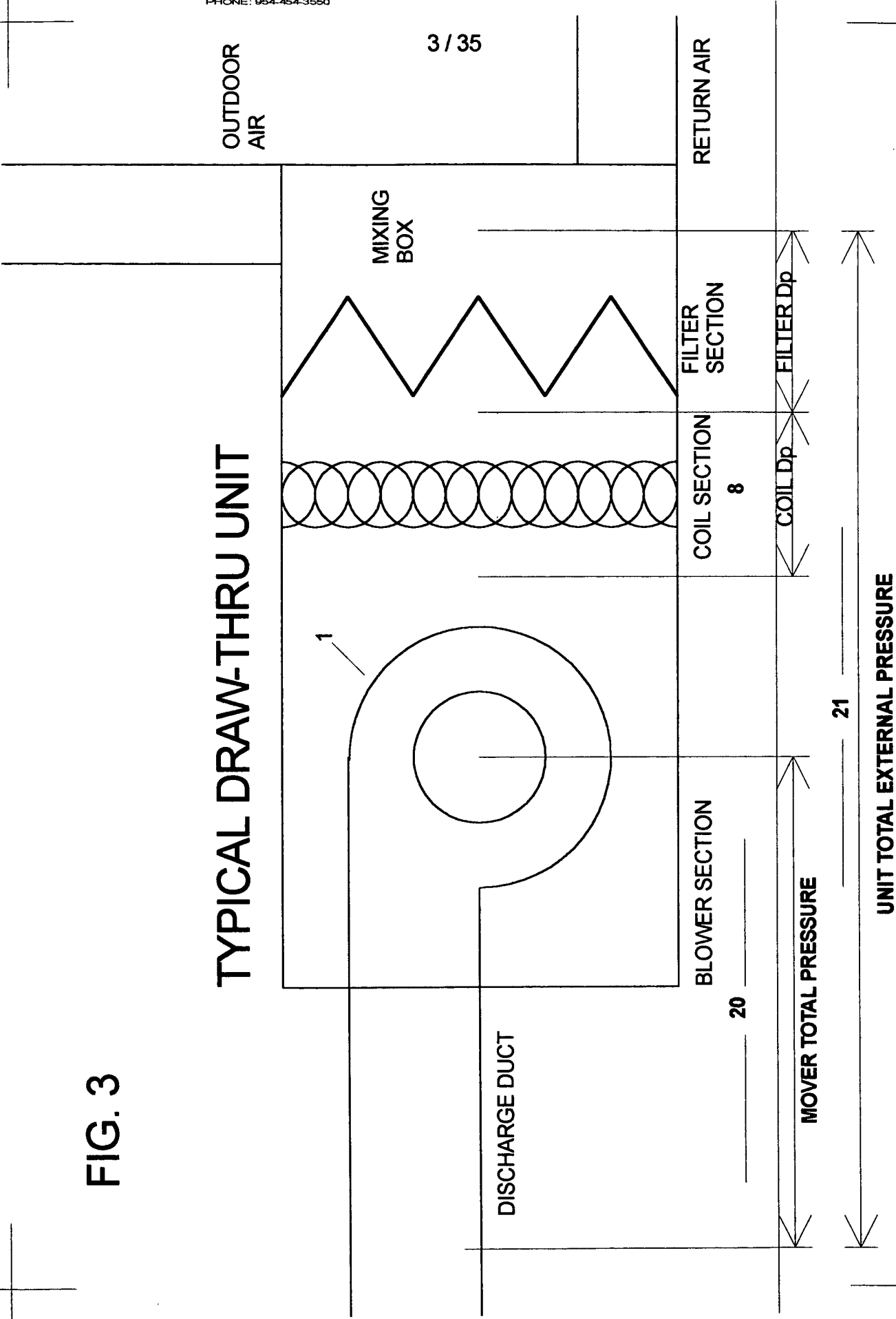


FIG. 1

FIG. 3



TRADITIONAL FAN PERFORMANCE CURVES

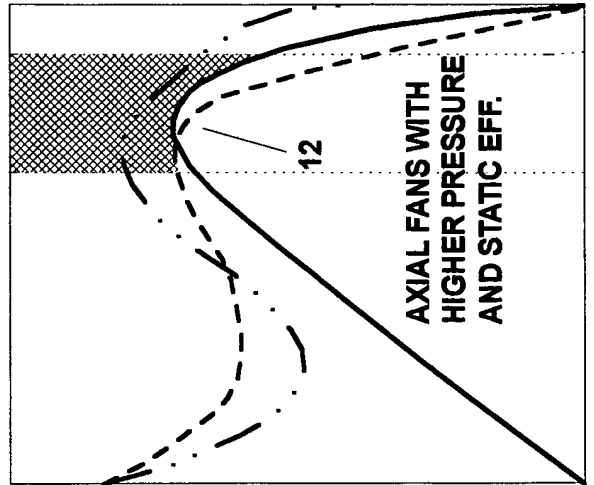
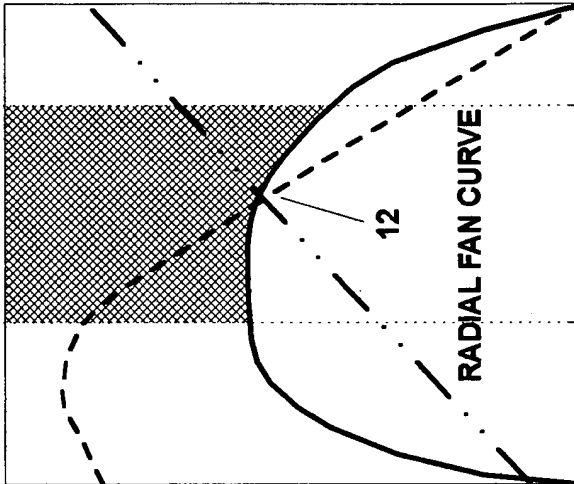
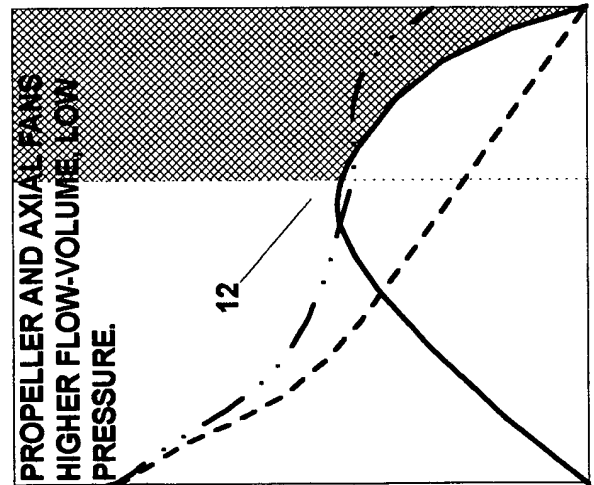
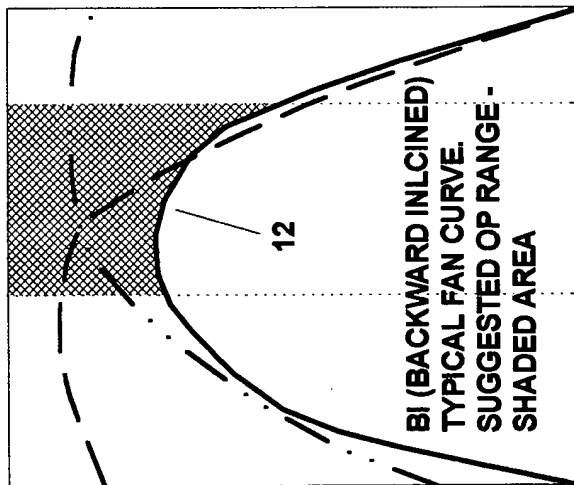
FIG. 5

SP — — — — —
 STATIC EFF. — — — — —
 BHP

SP CURVE OCCURS AT
 SPECIFIED FRPM AND IS THE
 BASIS FOR DETERMINING OP
 WHEN PLOTTED AGAINST
 A GIVEN SYSTEM.

NEW METHOD SHALL FURTHER
 BREAK DOWN THIS CURVE INTO
 THE THREE KEY COMPONENTS
 FOR ANALYSIS: SP, VP, TP

THIS WILL ALSO PROVIDE
 THE BEST MEANS OF PAIRING A
 PRIME MOVER AND ITS
 SYSTEM FOR EQUIPMENT
 SELECTION.



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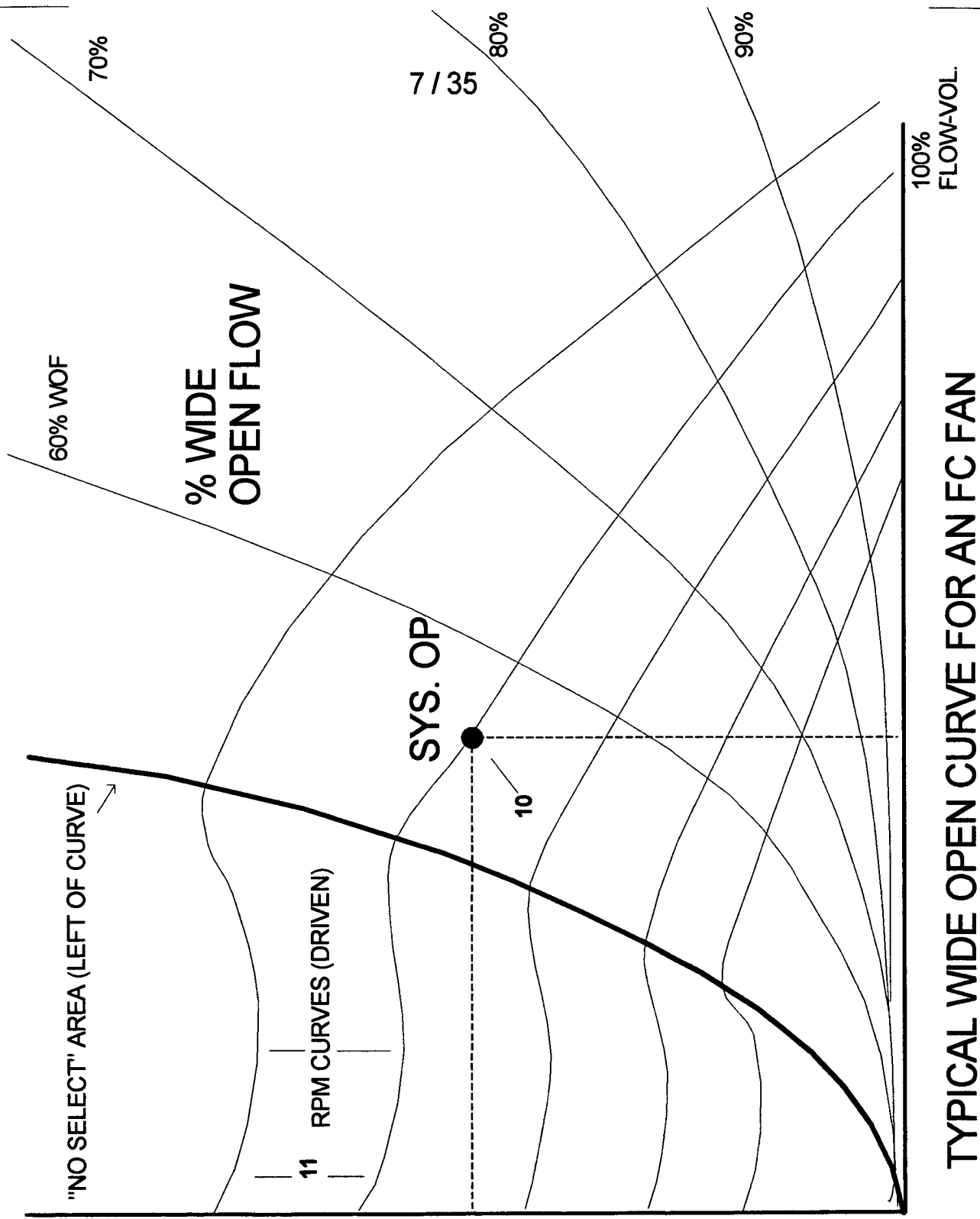


FIG. 6

TYPICAL WIDE OPEN CURVE FOR AN FC FAN

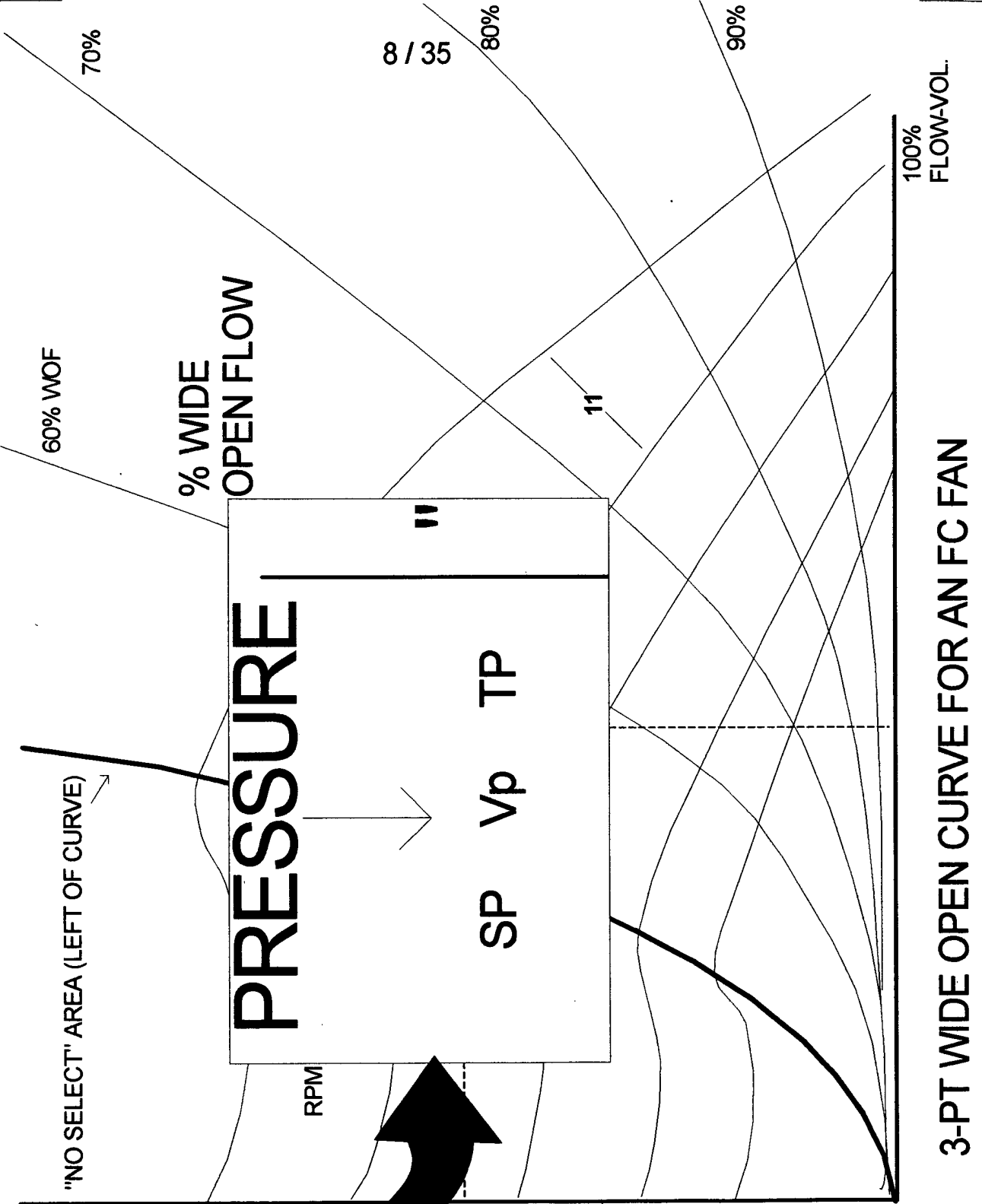


FIG. 6A

WIDE OPEN AND SYSTEM CURVES JUXTAPOSED

FIG. 7

KNOWN PRIME MOVER WOC

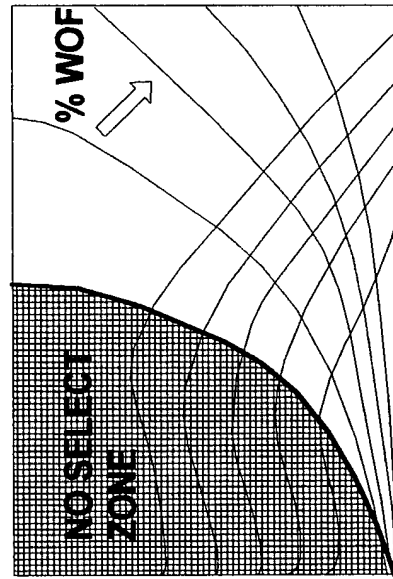
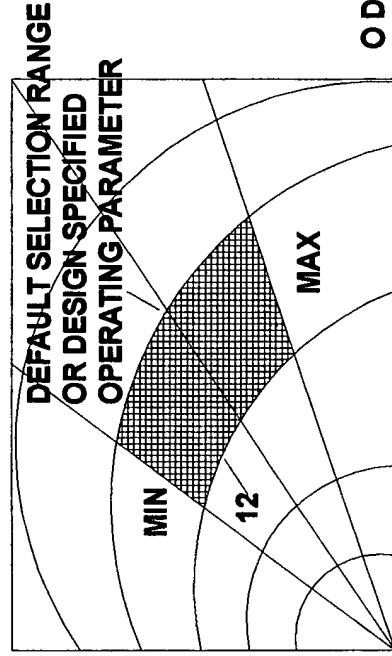


FIG. 7A

TERMINAL OR IN-LINE DEVICE WOC

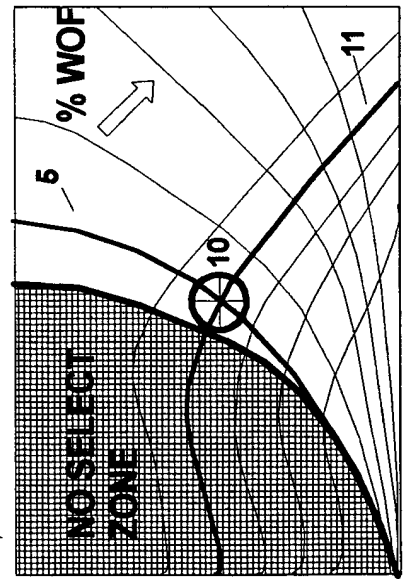


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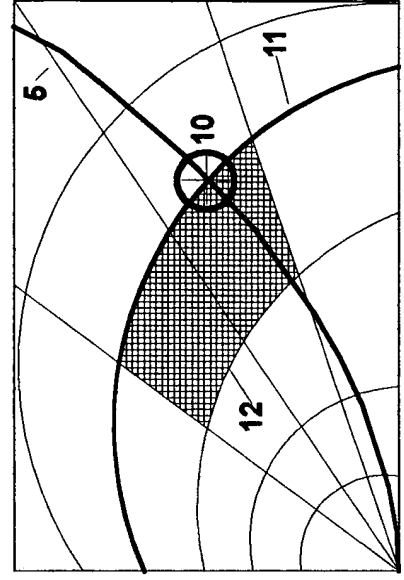


0 DEGREES OR
100% OPEN

UNKNOWN TOTAL SYSTEM ATTACHED



UNKNOWN SUB-SYSTEM ATTACHED



PRIMARY OR TERMINAL HEAT EXCHANGE

8

FIG. 8

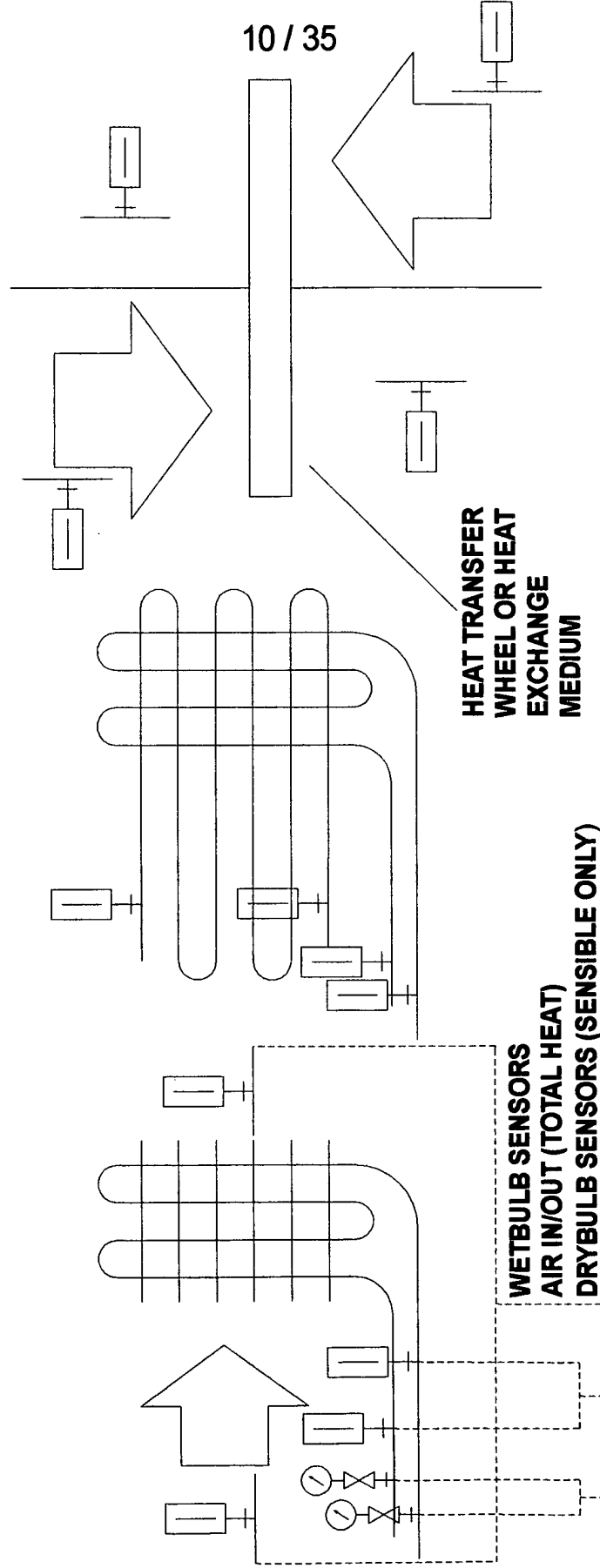
AIR TO WATER

FIG. 8A

WATER TO WATER

FIG. 8B

AIR TO AIR

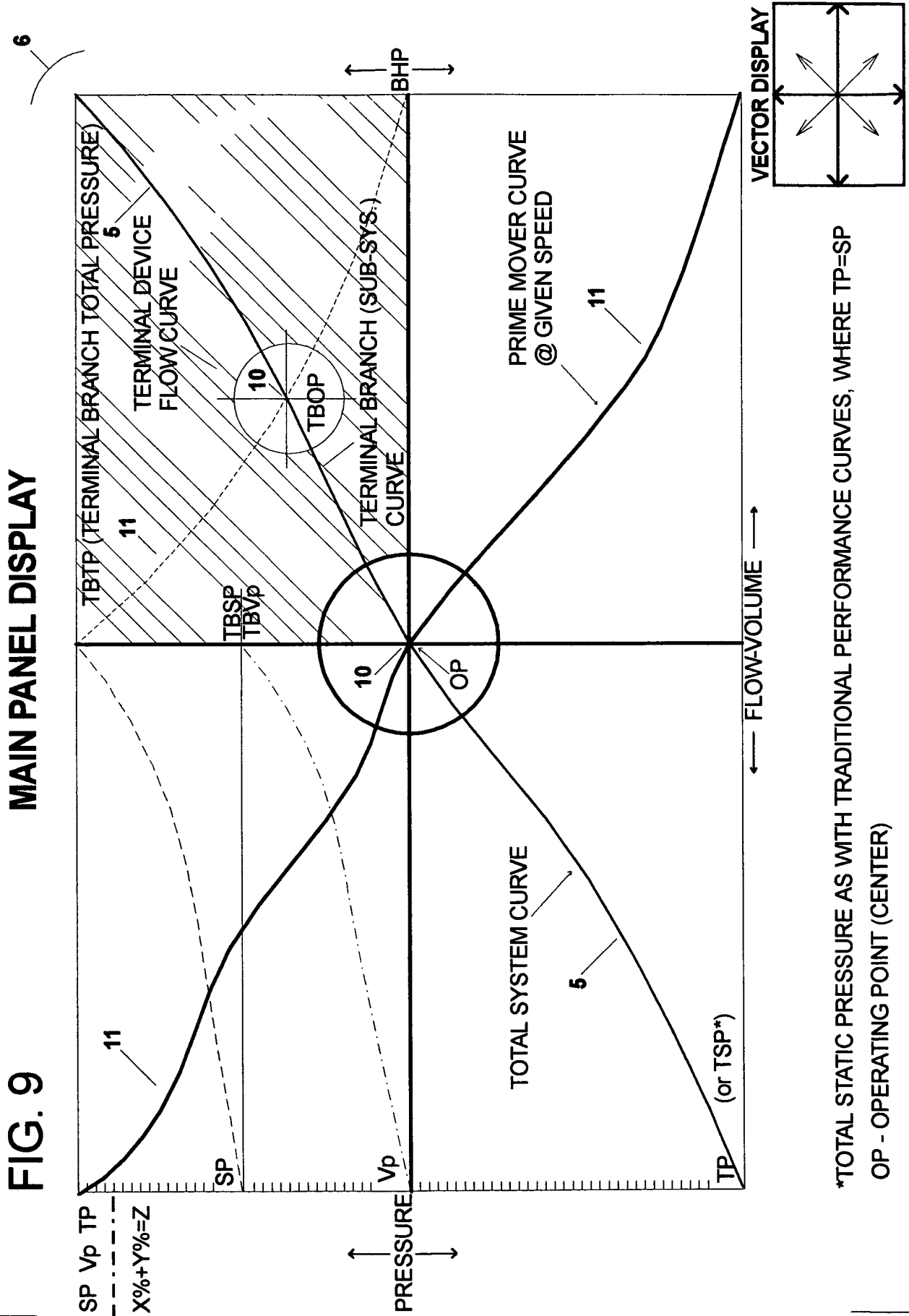


ENTERING AND LEAVING AIR TEMPERATURES IN COUNTER FLOW EXCHANGER

AIR-GAS-FLUIDS TO SAME
FLUIDS TO FLUIDS
GASES TO GASES
FLUIDS TO GASES, VICE VERSA
MIXTURES TO MIXTURES
(ALL OF THE ABOVE)

*VARIATIONS WOULD INCLUDE THE FOLLOWING IN ANY ARRANGEMENT, FORM, NUMBER, OR COMBINATION:

MAIN PANEL DISPLAY



*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE TP=SP
OP - OPERATING POINT (CENTER)

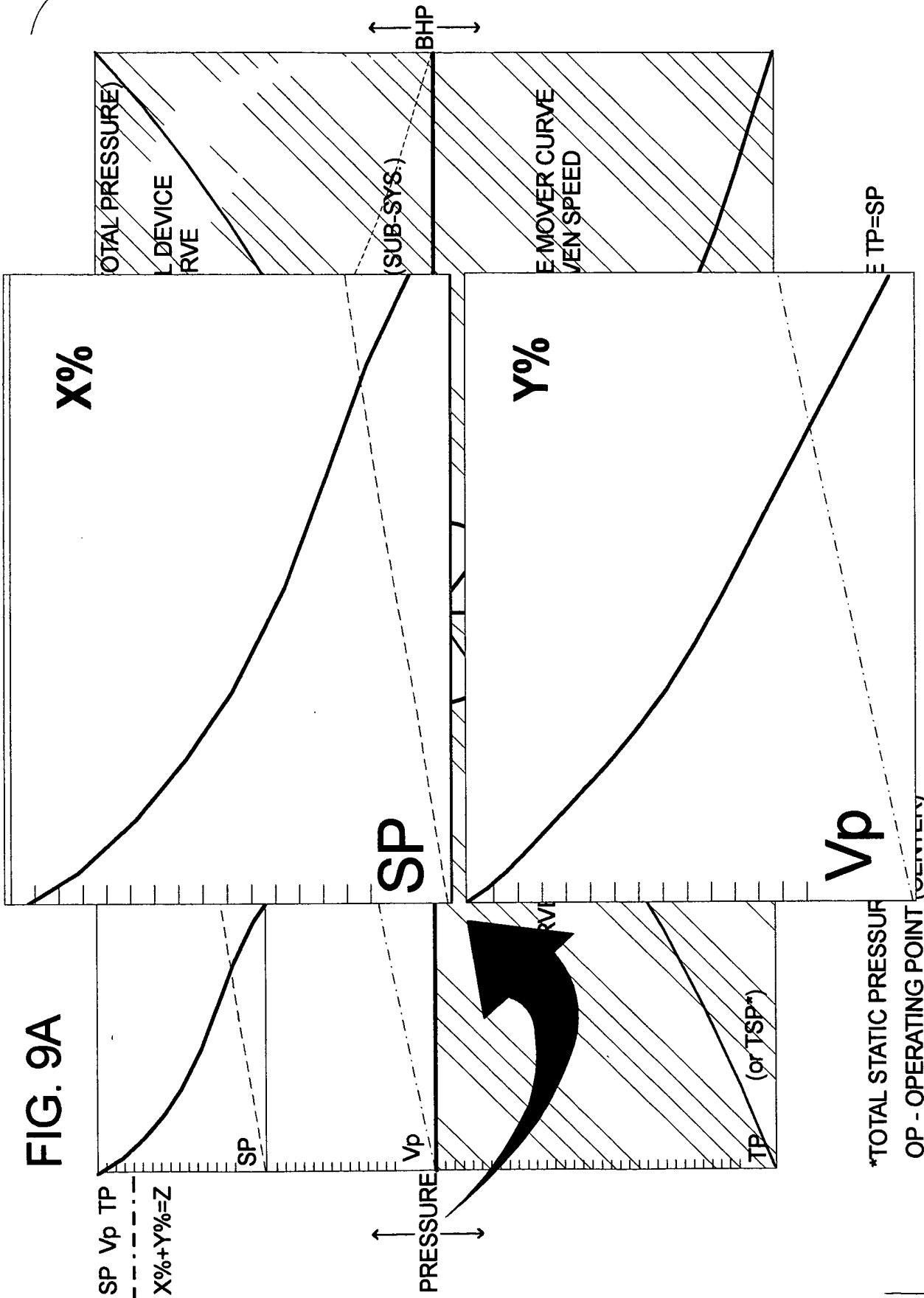
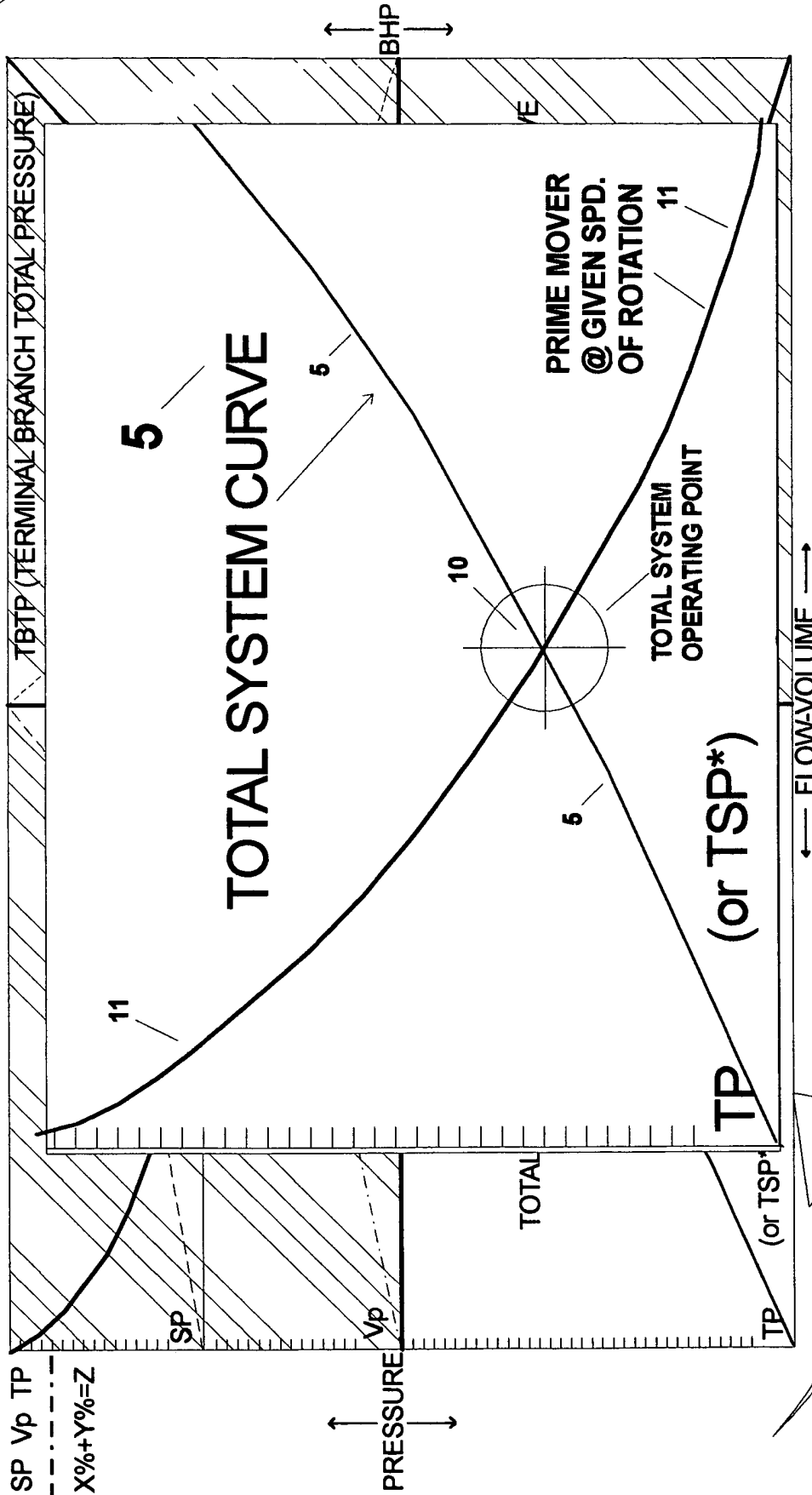


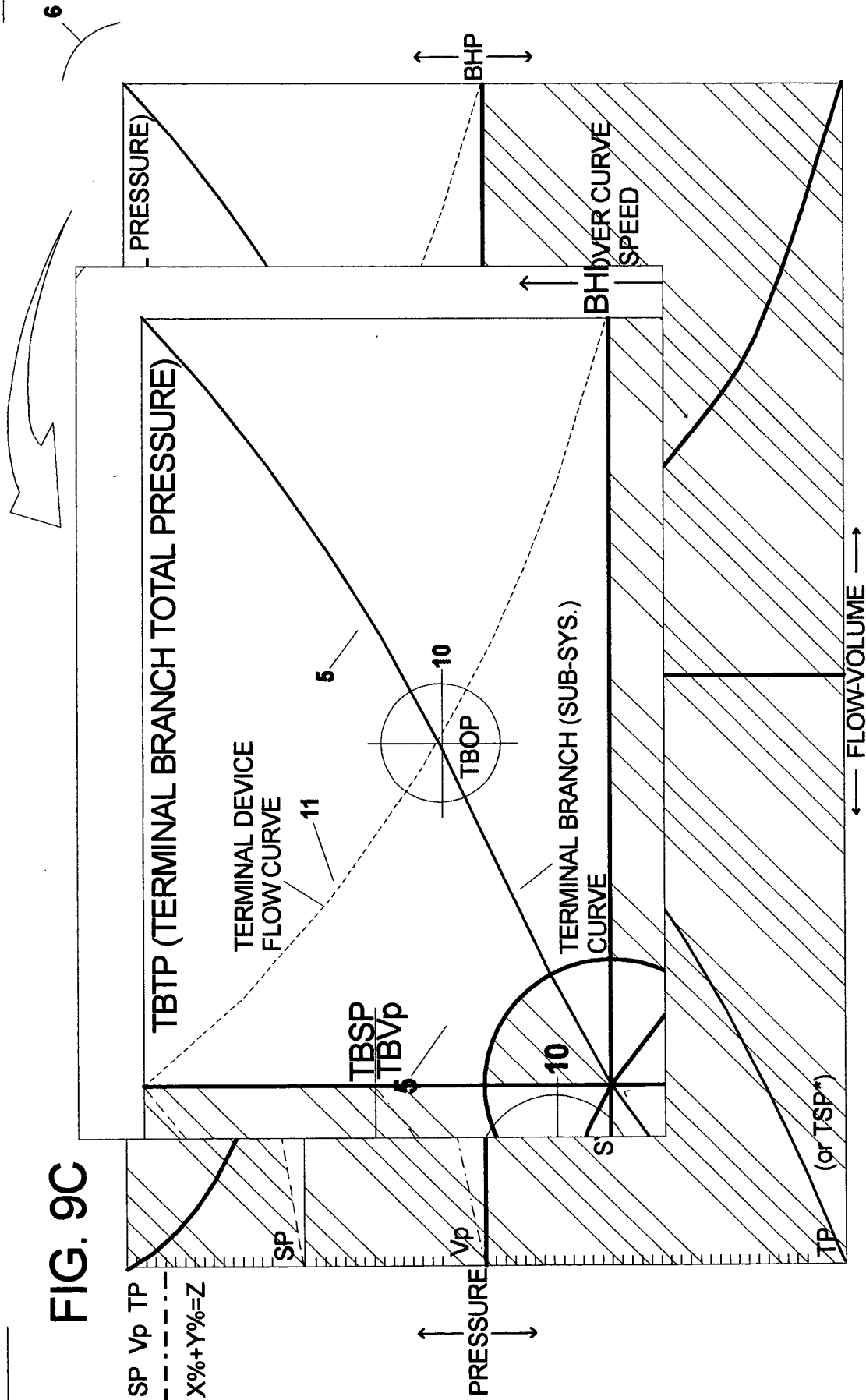
FIG. 9B



*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE TP=SP
OP - OPERATING POINT (CENTER)

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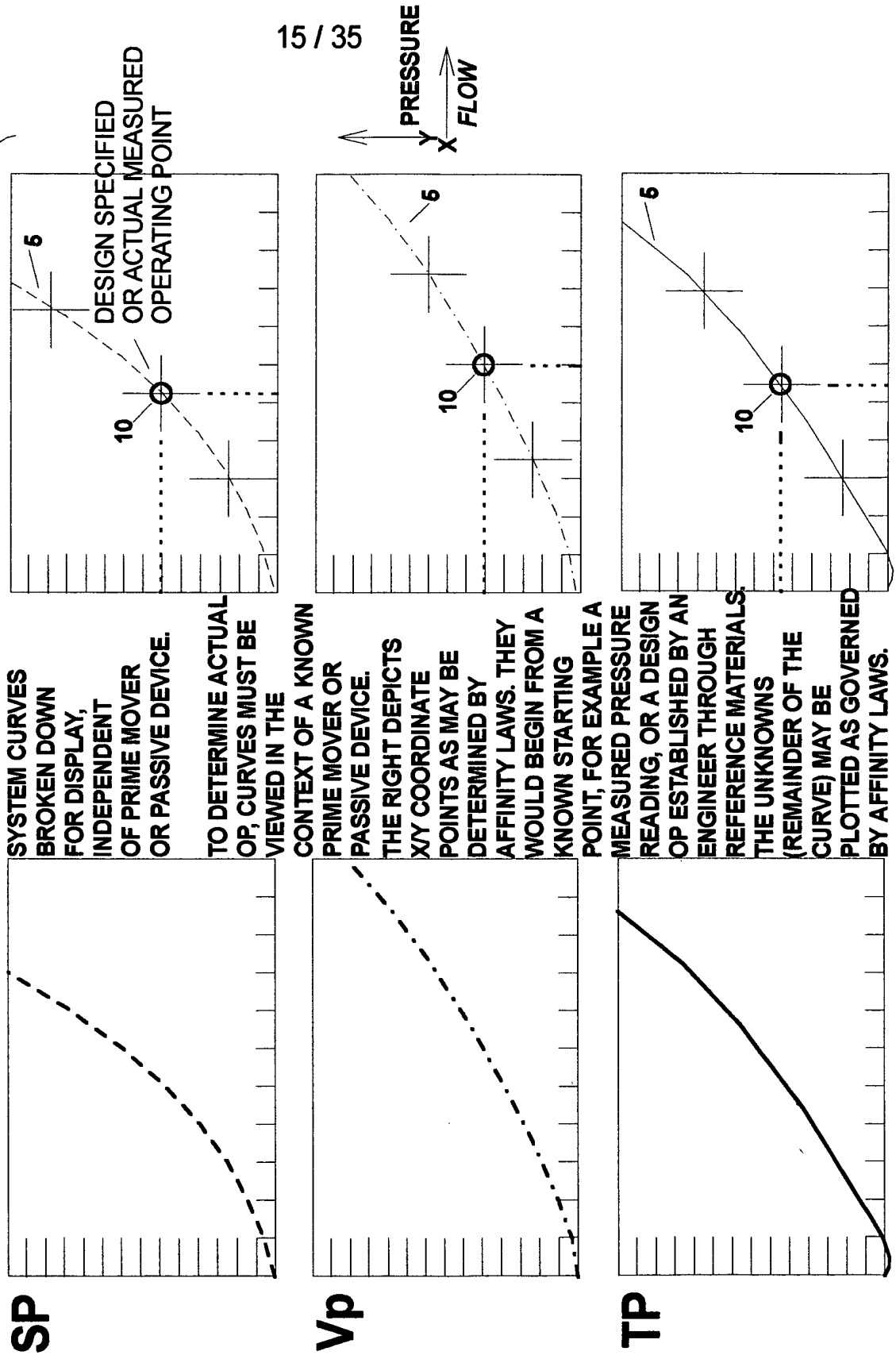
FIG. 9C



*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE TP=SP
OP - OPERATING POINT (CENTER)

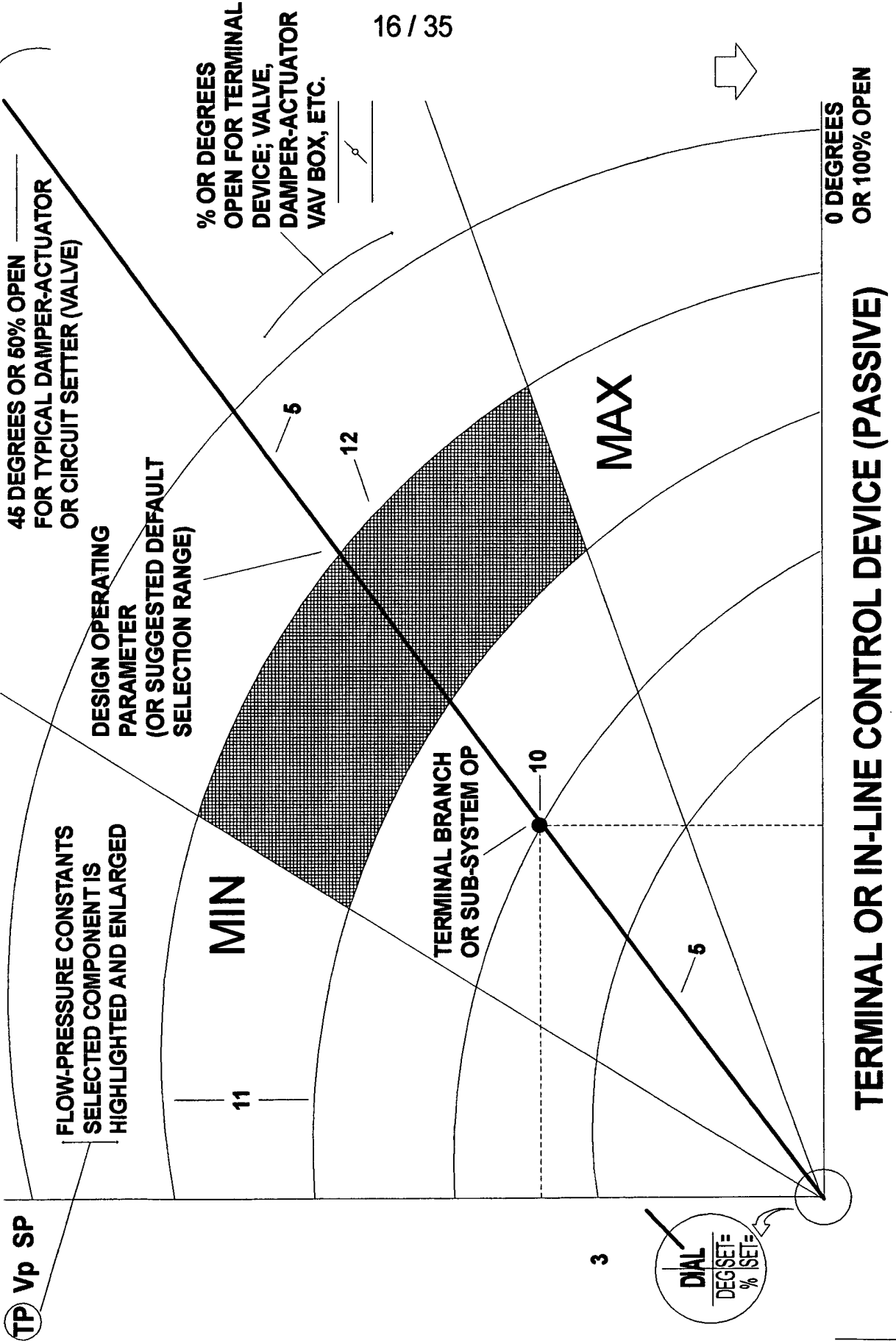
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FIG. 10 3-PART SYSTEM CURVES VIEWED INDEPENDENTLY



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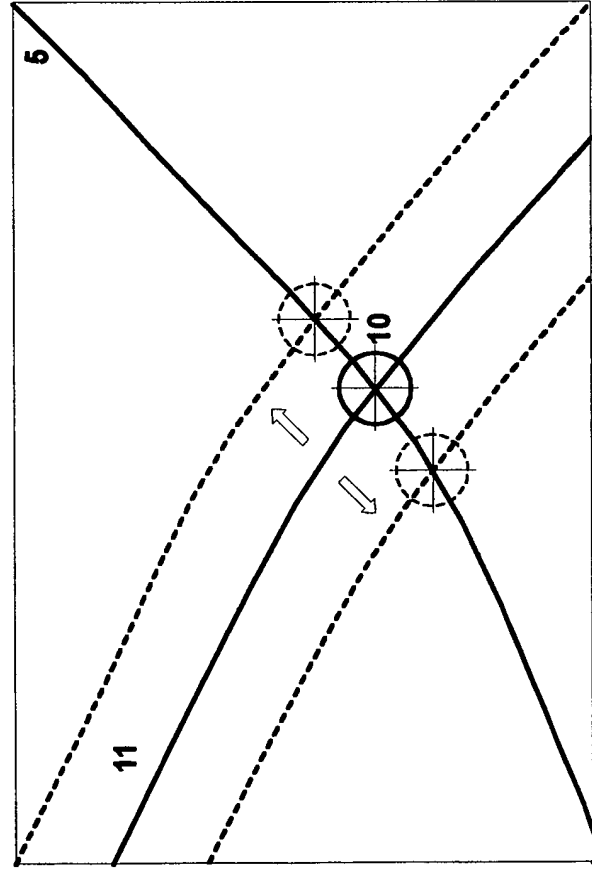
FIG. 11 TERMINAL DEVICE (WOC) WIDE OPEN CURVE



CURVE RIDING AND OP DEVIATION

6

FIG. 12



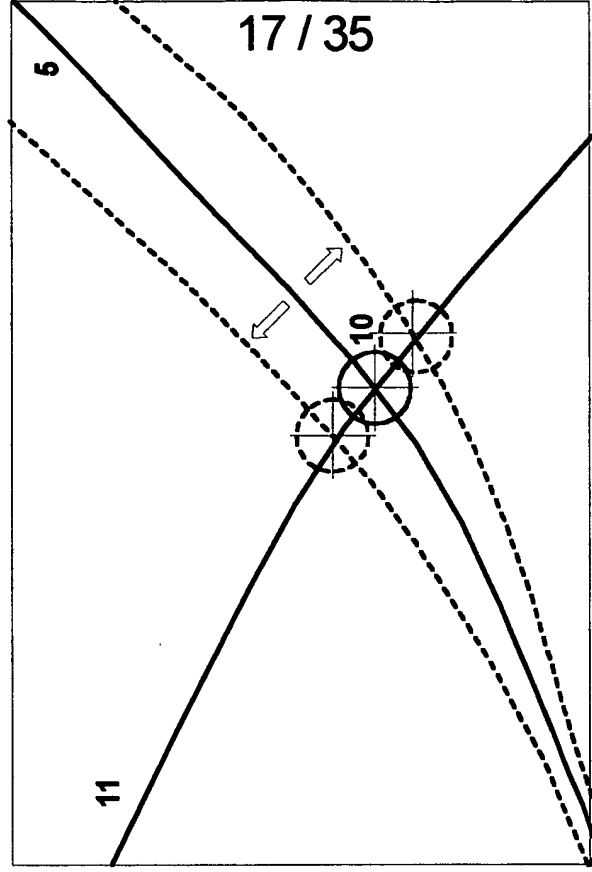
PRIME MOVER CHANGES

ROTATIONAL SPEED

SECONDARY MOVER

**SERIES OR PARALLEL
OPERATION**

FIG. 12A



SYSTEM CHANGES

TP SP Vp

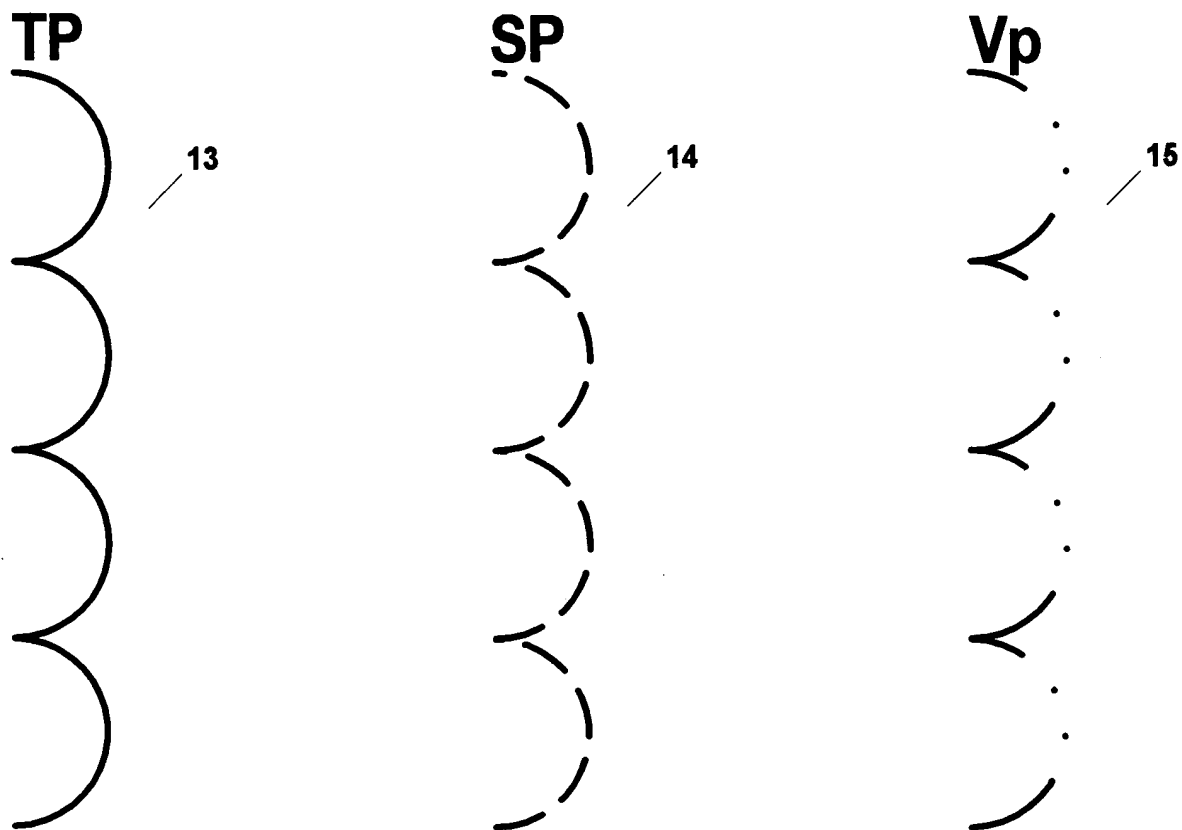
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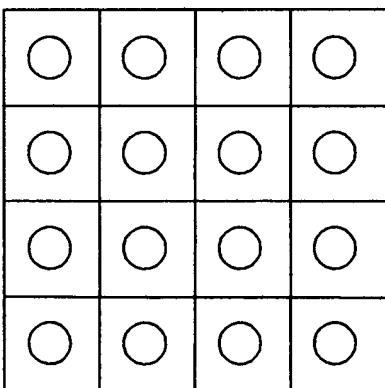
PHONE: 954-454-3550

FIG. 13

SENSOR LOGIC

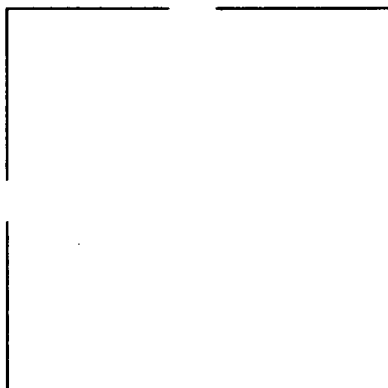


DUCT CROSS-SECTIONAL EQUAL AREA TRAVERSE



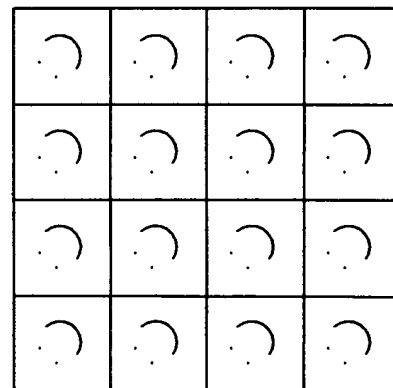
TOTAL IMPACT SENSORS

13



STATIC ONLY SENSORS

14



VELOCITY ONLY SENSORS

TP-SP, AS WITH PITOT TUBE

15

PRIME MOVER SENSOR LOGIC

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FIG. 14

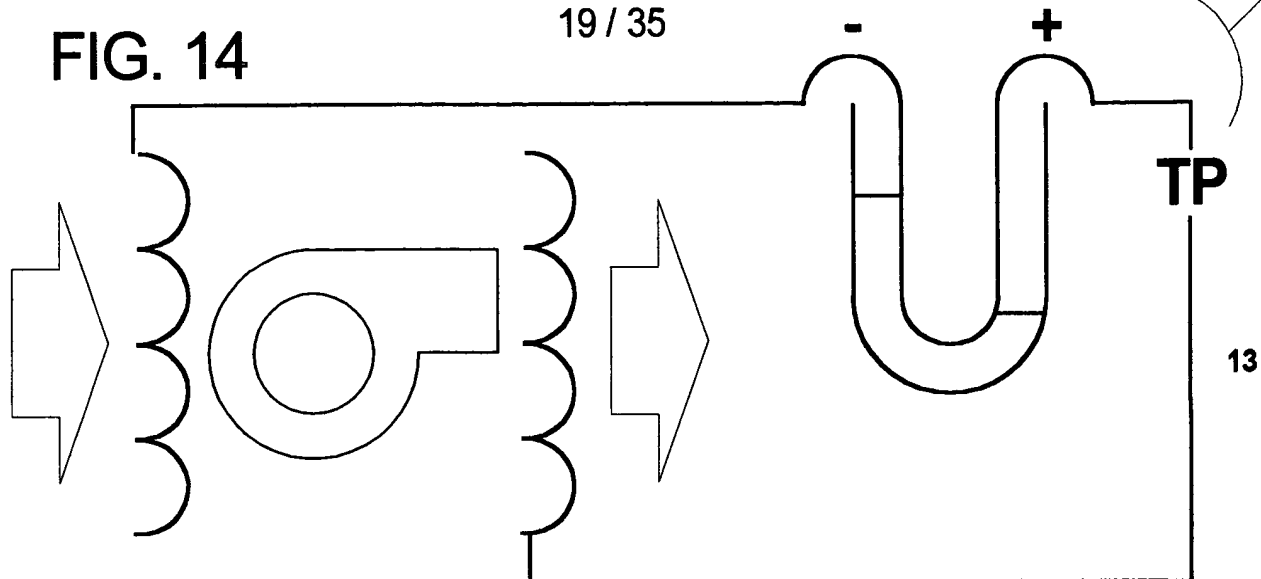


FIG. 14A

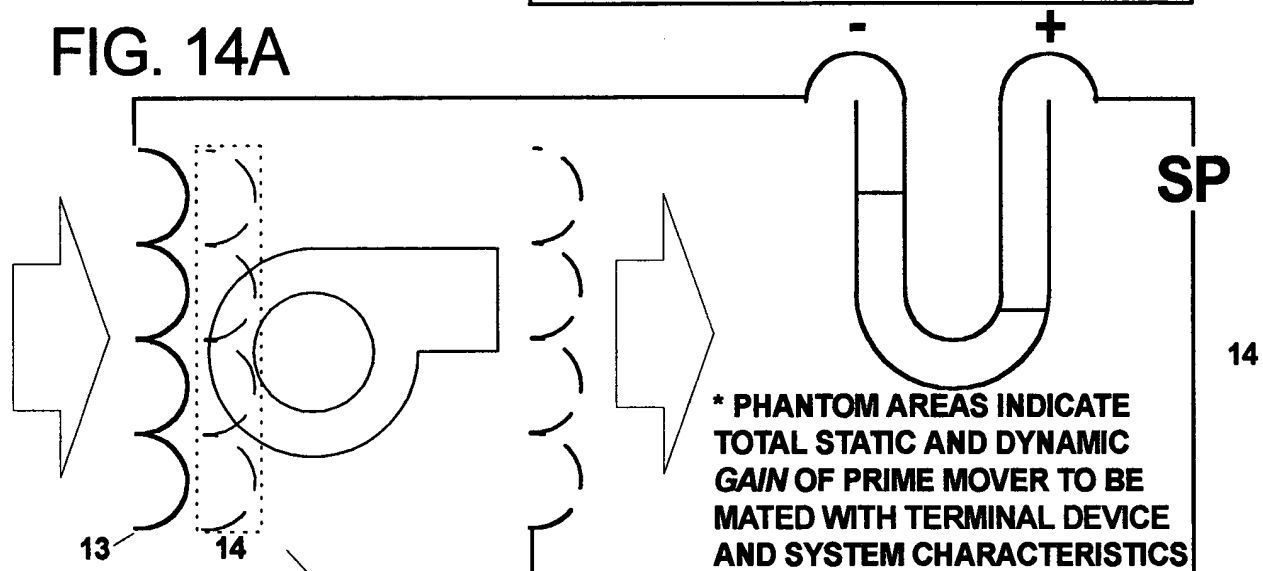
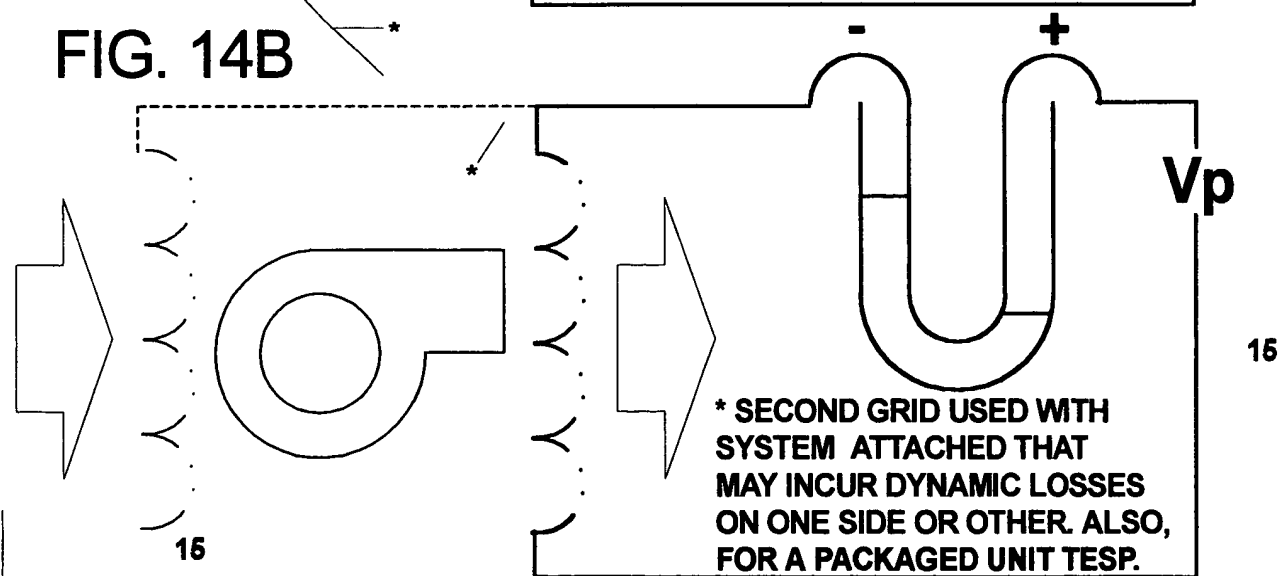


FIG. 14B

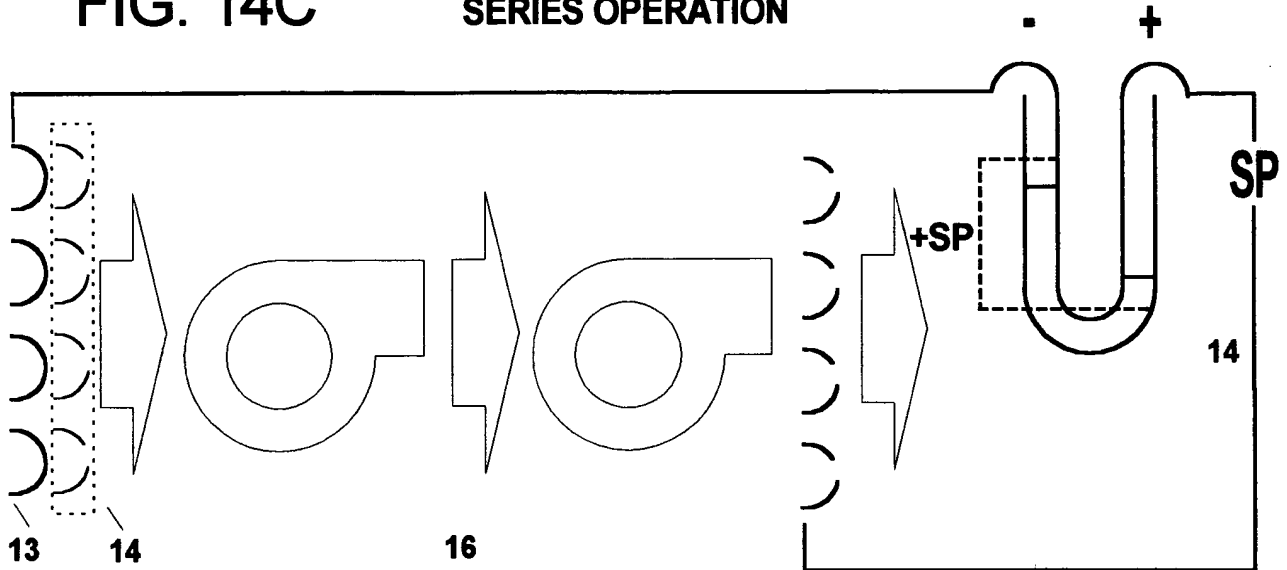


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MOVER SENSOR LOGIC IN SERIES OR PARALLEL OPERATION

FIG. 14C

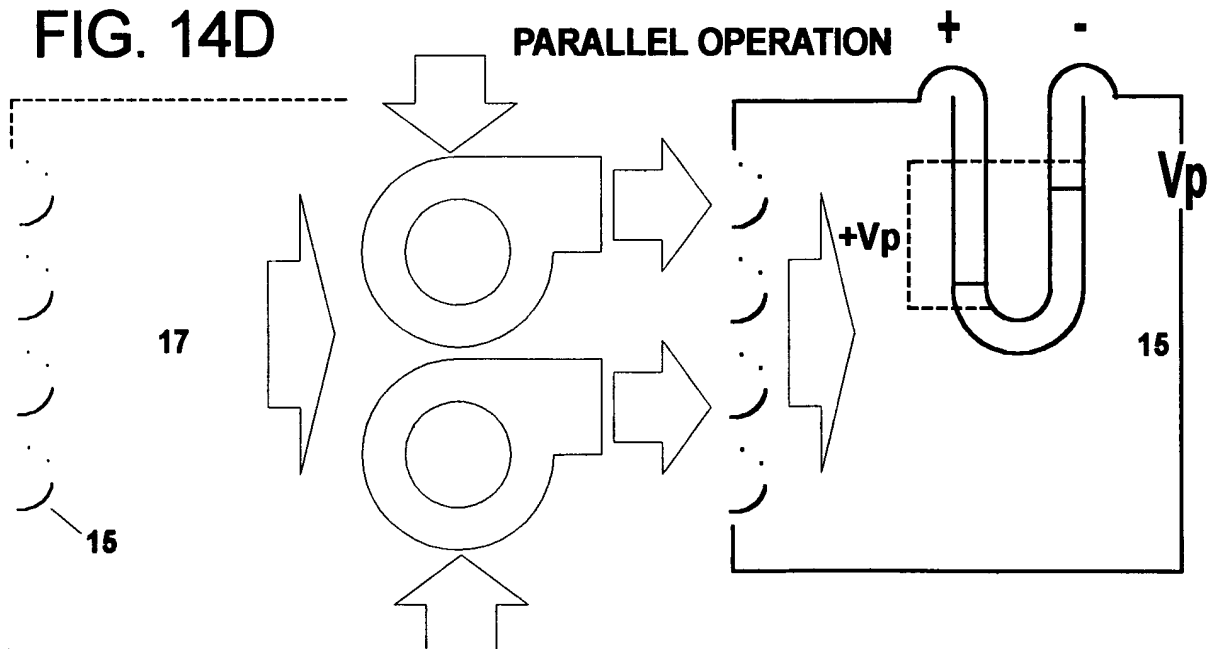
SERIES OPERATION



ONE OR MORE PRIMARY MOVERS IN SERIES OR PARALLEL
AUGMENT EITHER SP OR V_p , RESPECTIVELY, AS SHOWN.

FIG. 14D

PARALLEL OPERATION



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FIG. 15 **SENSOR LOGIC**

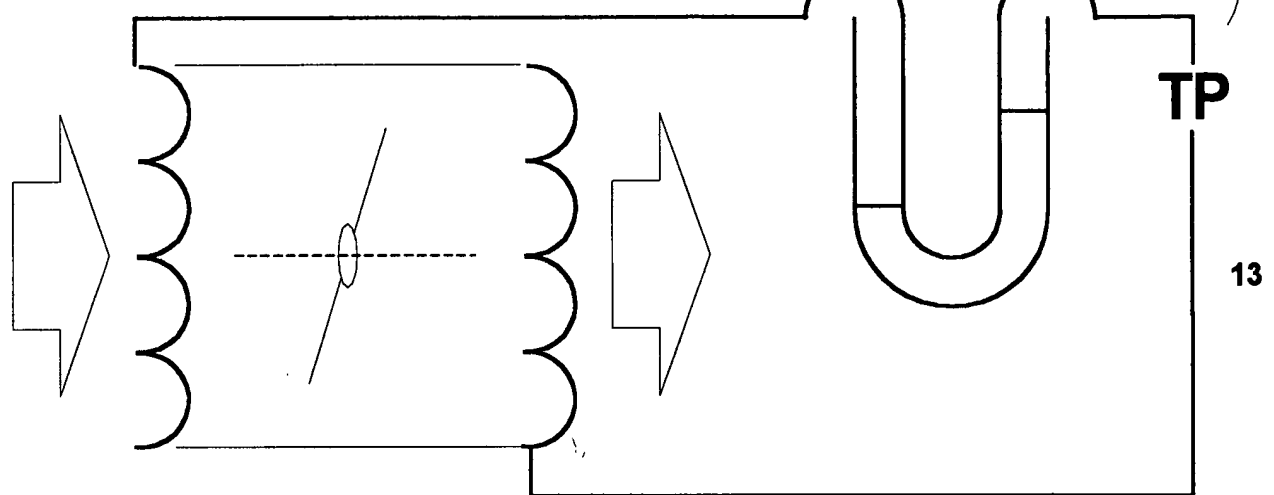


FIG. 15A

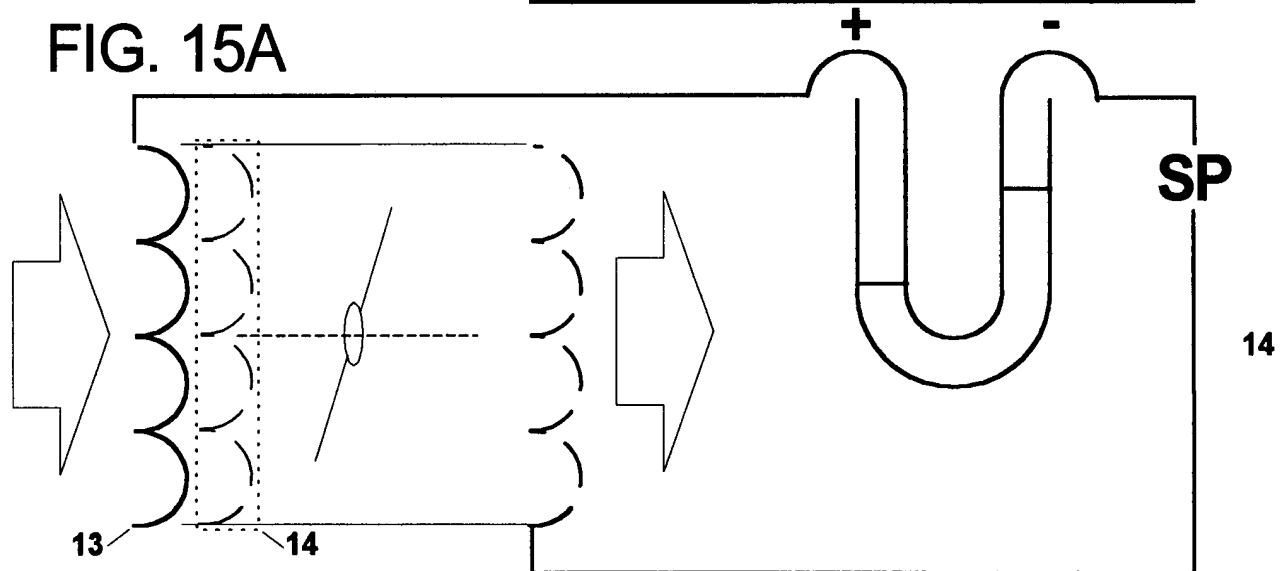
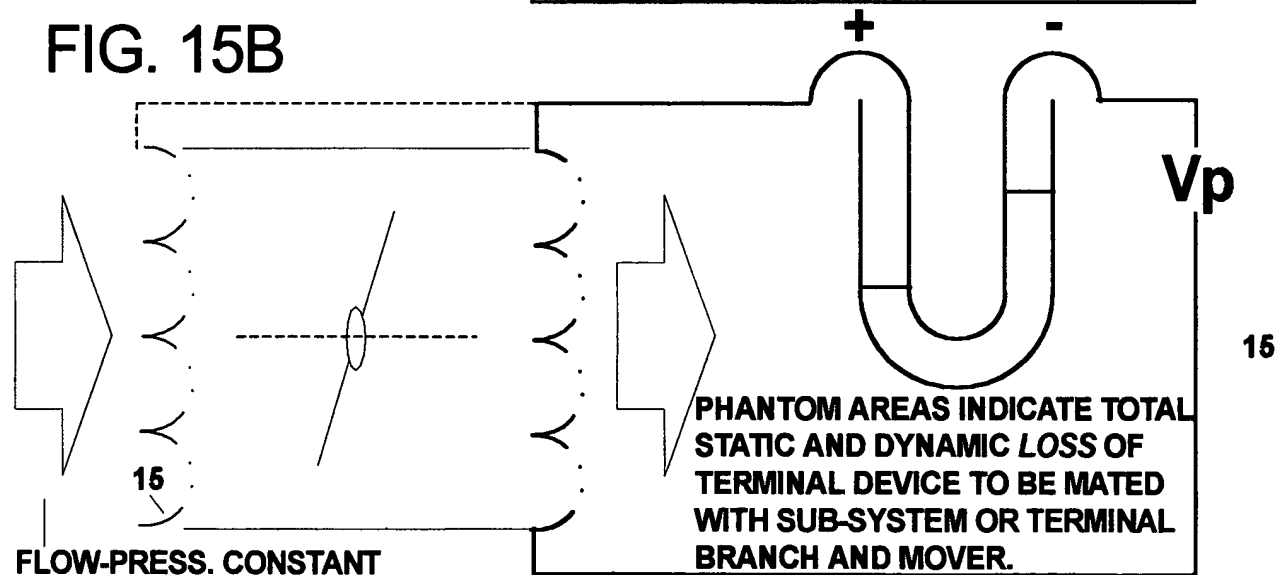


FIG. 15B

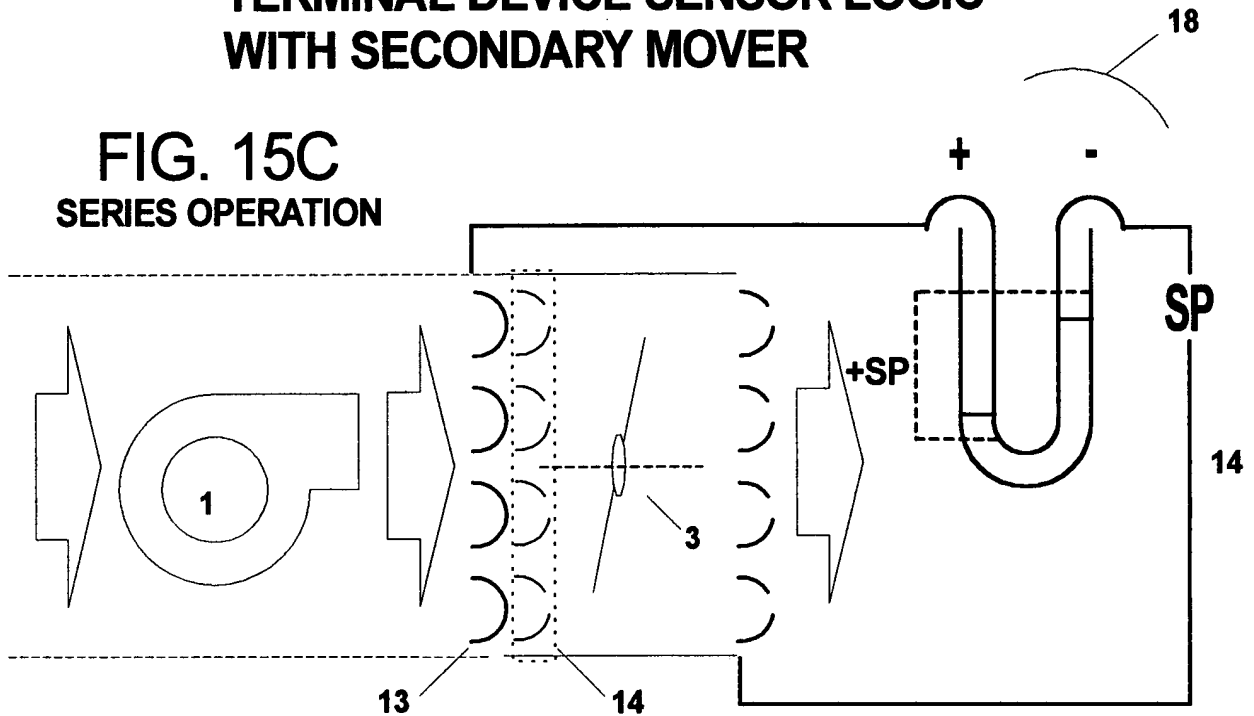


FLOW-PRESS. CONSTANT

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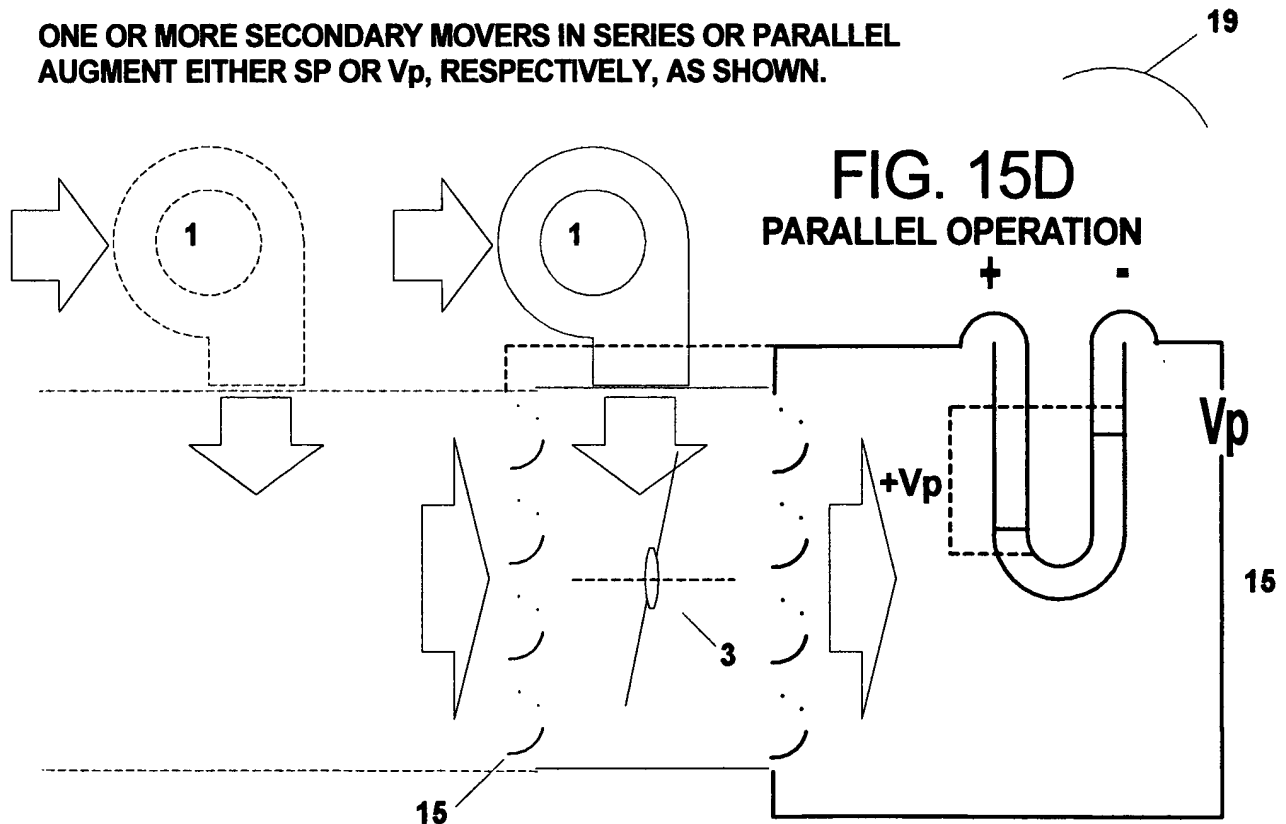
TERMINAL DEVICE SENSOR LOGIC WITH SECONDARY MOVER

FIG. 15C
SERIES OPERATION



ONE OR MORE SECONDARY MOVERS IN SERIES OR PARALLEL
AUGMENT EITHER SP OR V_p , RESPECTIVELY, AS SHOWN.

FIG. 15D
PARALLEL OPERATION

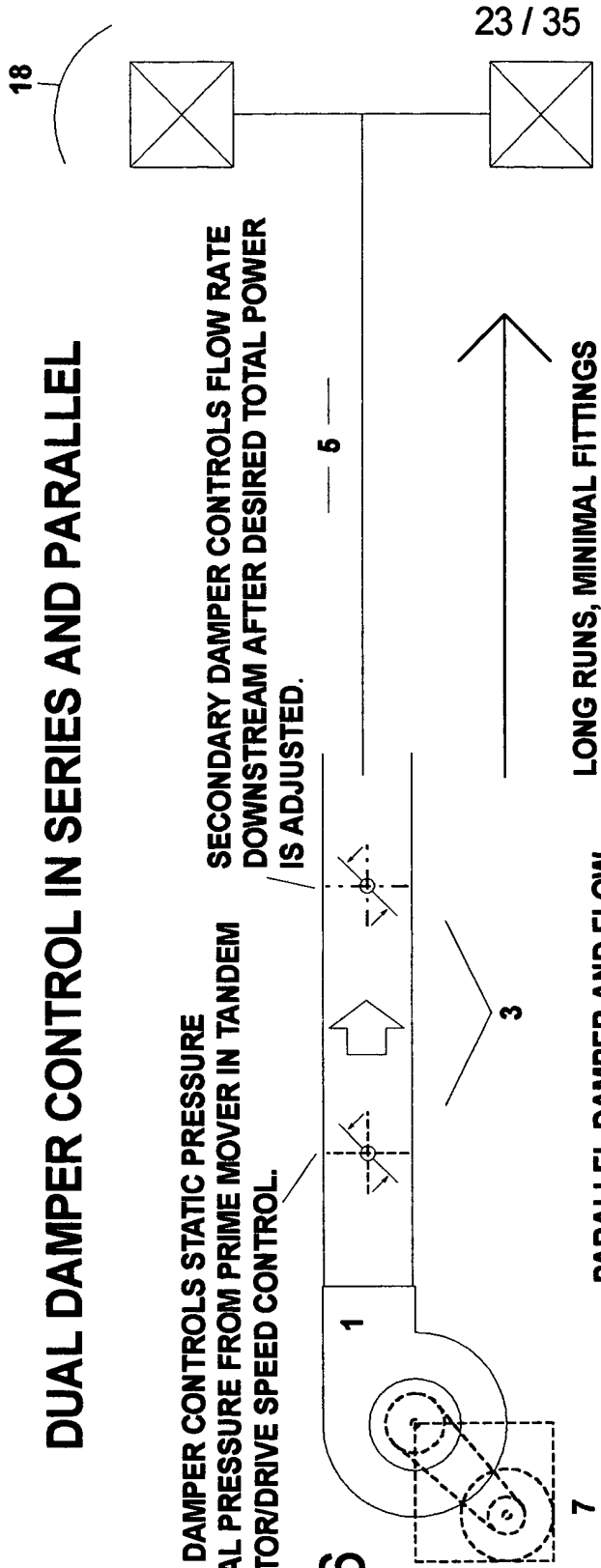


DUAL DAMPER CONTROL IN SERIES AND PARALLEL

PRIMARY DAMPER CONTROLS STATIC PRESSURE AND TOTAL PRESSURE FROM PRIME MOVER IN TANDEM WITH MOTOR/DRIVE SPEED CONTROL.

SECONDARY DAMPER CONTROLS FLOW RATE DOWNSTREAM AFTER DESIRED TOTAL POWER IS ADJUSTED.

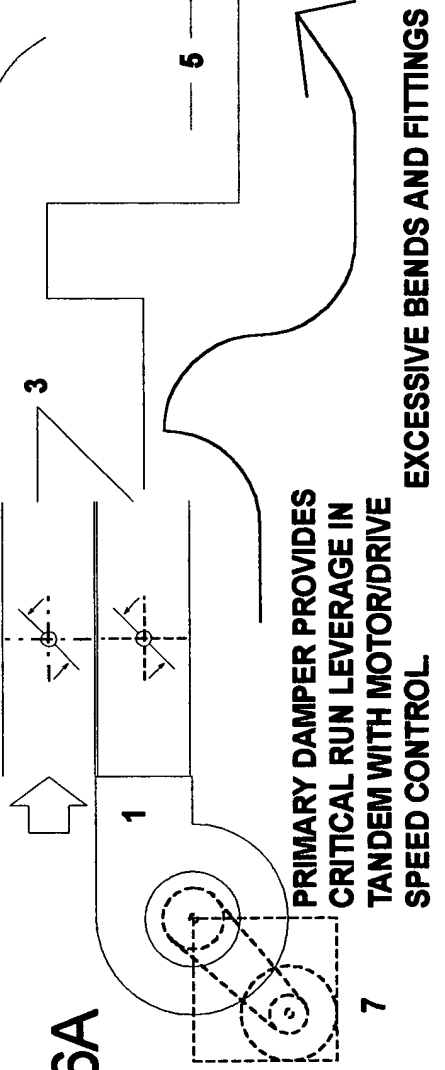
FIG. 16



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PARALLEL DAMPER AND FLOW SOURCE PROVIDES CUMULATIVE VELOCITY TO TRAVERSE FITTING AND DIRECTIONAL LOSSES

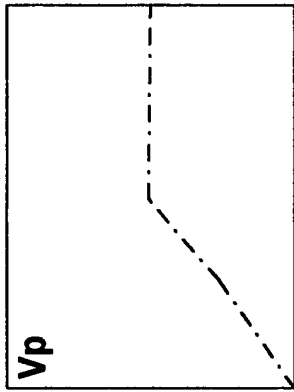
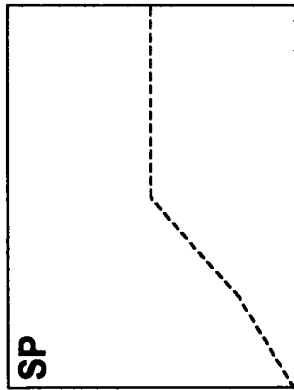
FIG. 16A



PRIMARY DAMPER PROVIDES CRITICAL RUN LEVERAGE IN TANDEM WITH MOTOR/DRIVE SPEED CONTROL

LEAKAGE TESTER

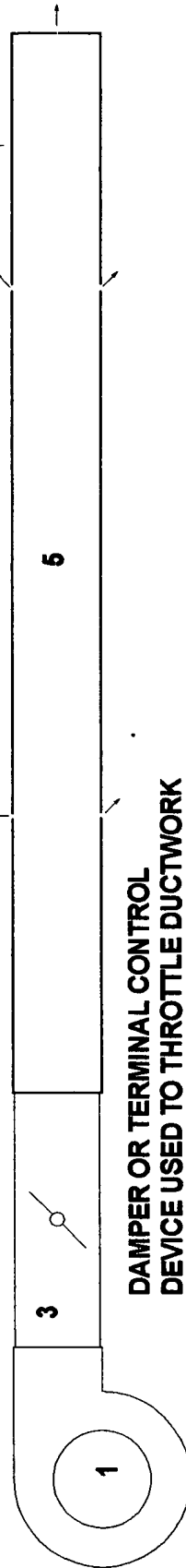
SP LEVEL ADJUSTED TO DUCTWORK RATING TO PERFORM STANDARD TEST FOR GIVEN SECTION



Vp CURVE LEVEL OFF INDICATES LEAKAGE AMOUNT PER SURFACE AREA OF DUCT

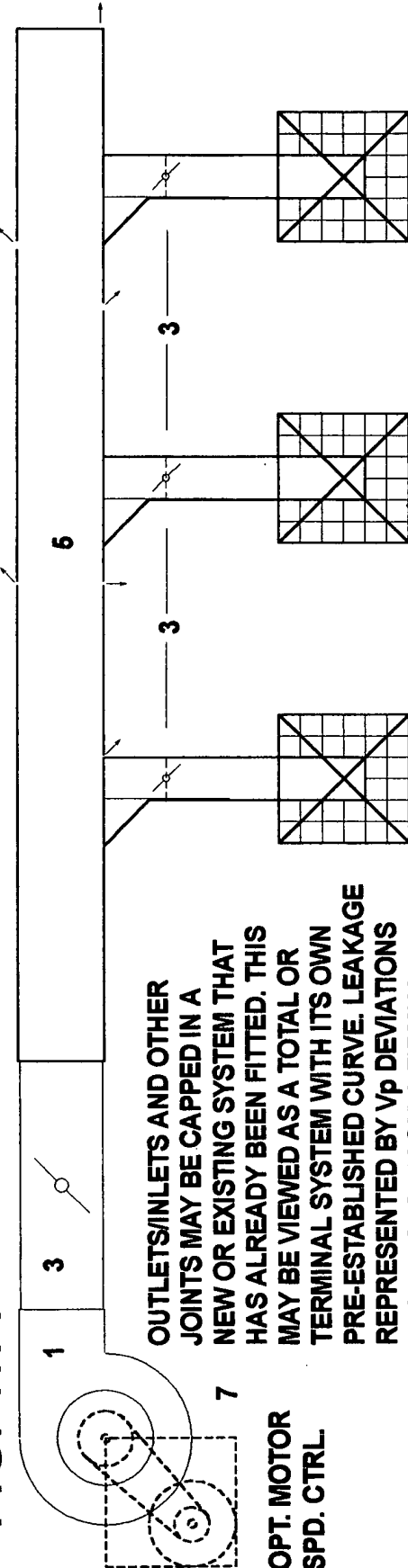
DUCT SOX OR COMPLETELY CAPPED MAIN SECTION.

FIG. 17



DAMPER OR TERMINAL CONTROL DEVICE USED TO THROTTLE DUCTWORK TO ITS GIVEN PRESSURE RATING AND MAINTAIN THIS LEVEL

FIG. 17A

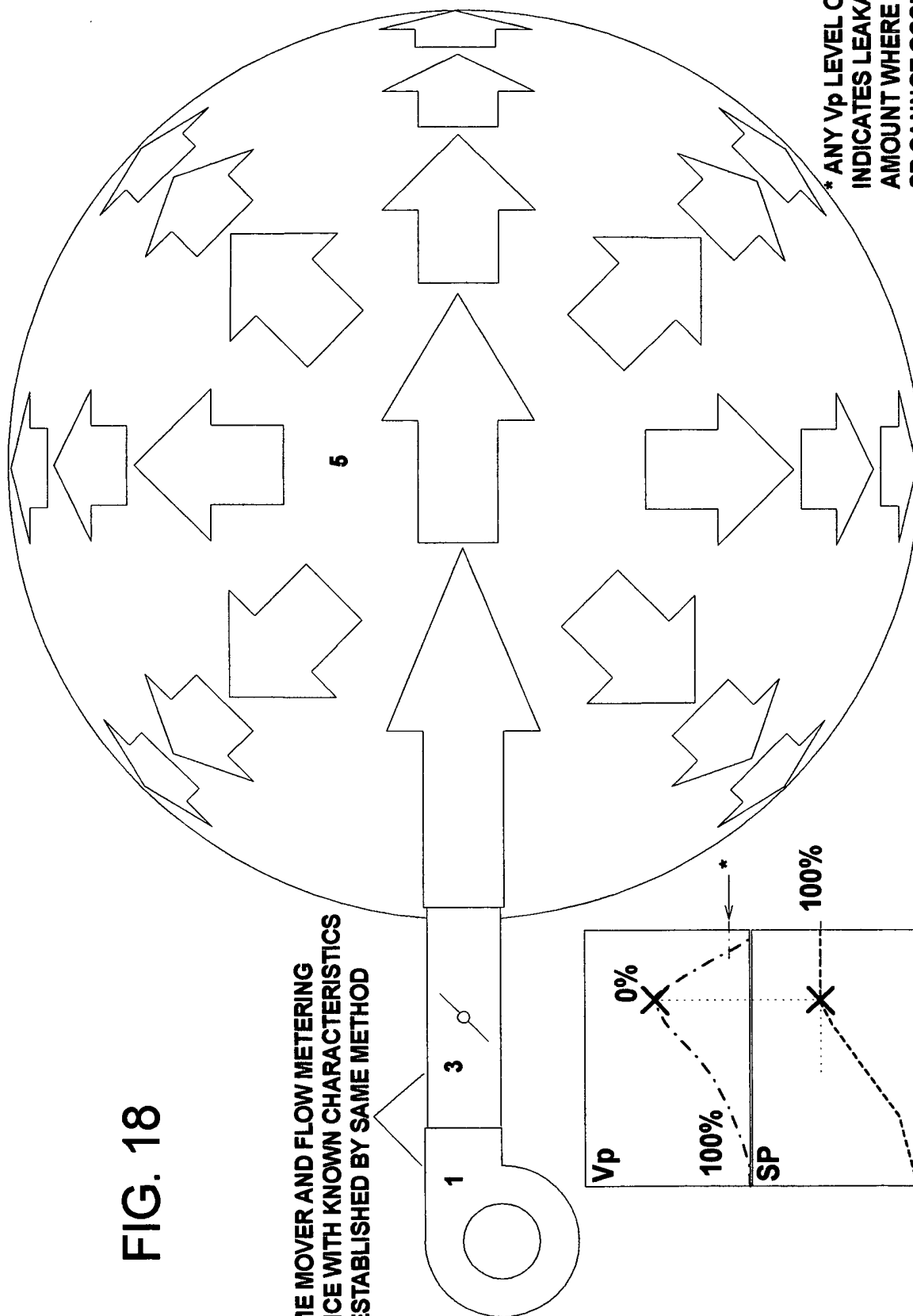


OUTLETS/INLETS AND OTHER JOINTS MAY BE CAPPED IN A NEW OR EXISTING SYSTEM THAT HAS ALREADY BEEN FITTED. THIS MAY BE VIEWED AS A TOTAL OR TERMINAL SYSTEM WITH ITS OWN PRE-ESTABLISHED CURVE. LEAKAGE REPRESENTED BY Vp DEVIATIONS (INCREASES) FROM A FIRMLY ESTABLISHED OPERATING POINT. SEE FIG. 12, 12A, OP DEVIATION.

OPT. MOTOR SPD. CTRL

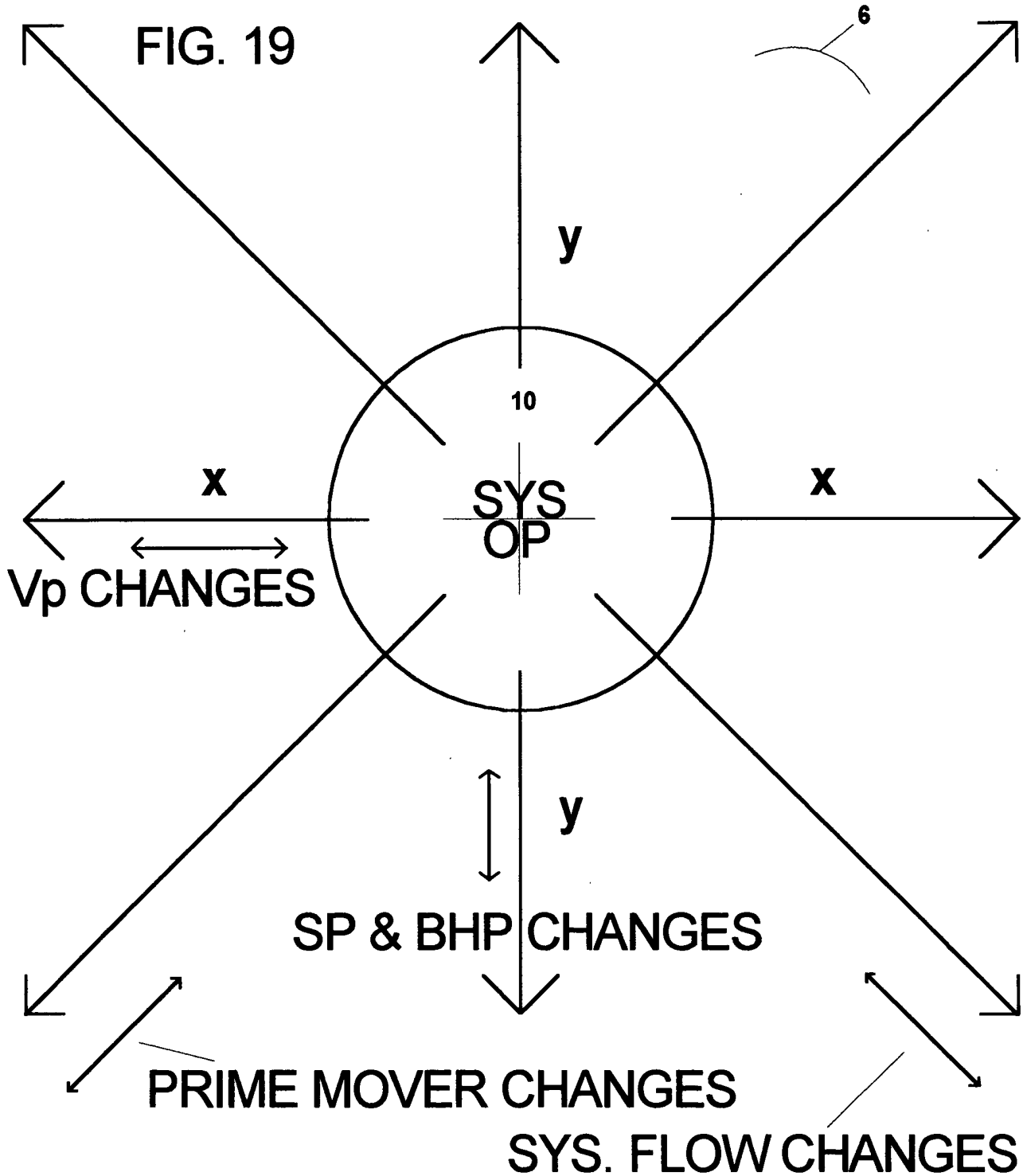
FIG. 18

PRIME MOVER AND FLOW METERING DEVICE WITH KNOWN CHARACTERISTICS AS ESTABLISHED BY SAME METHOD



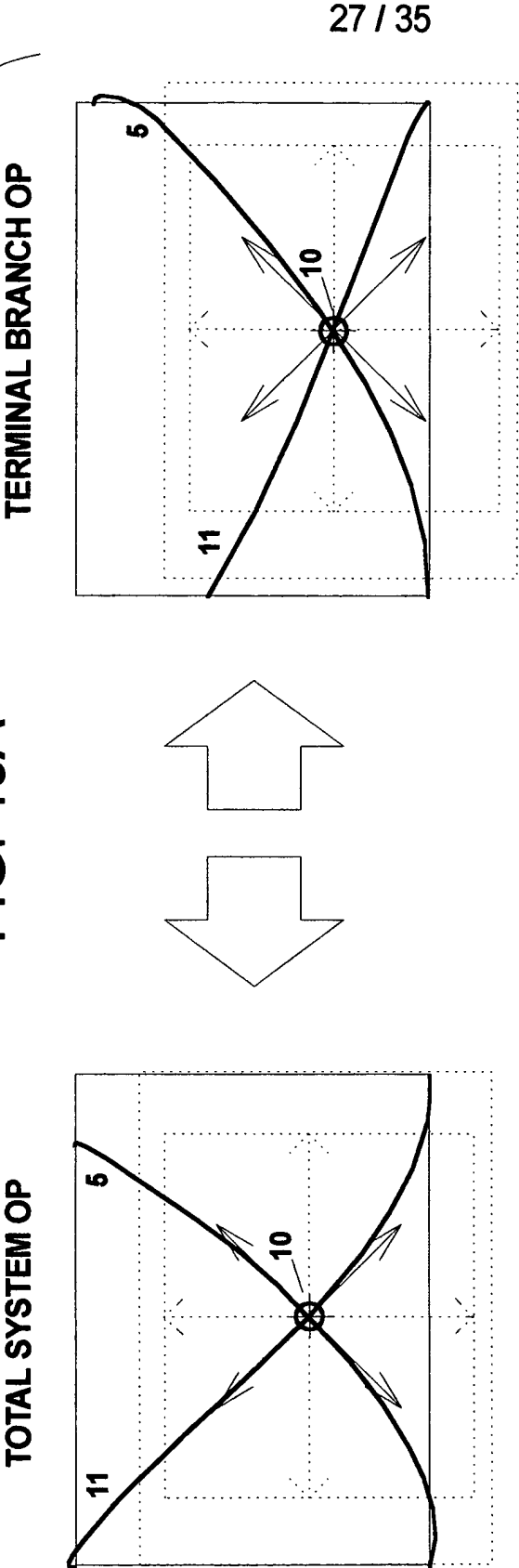
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VECTORIAL DISPLAY



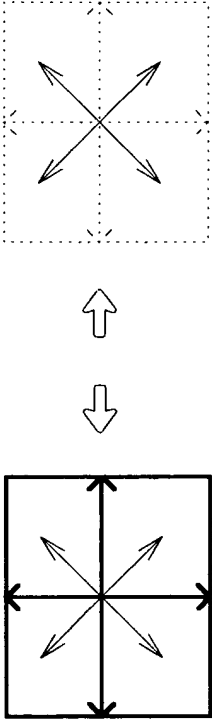
VECTORIAL ANALYSIS - TOTAL SYSTEM TO SUB-SYSTEM

FIG. 19A



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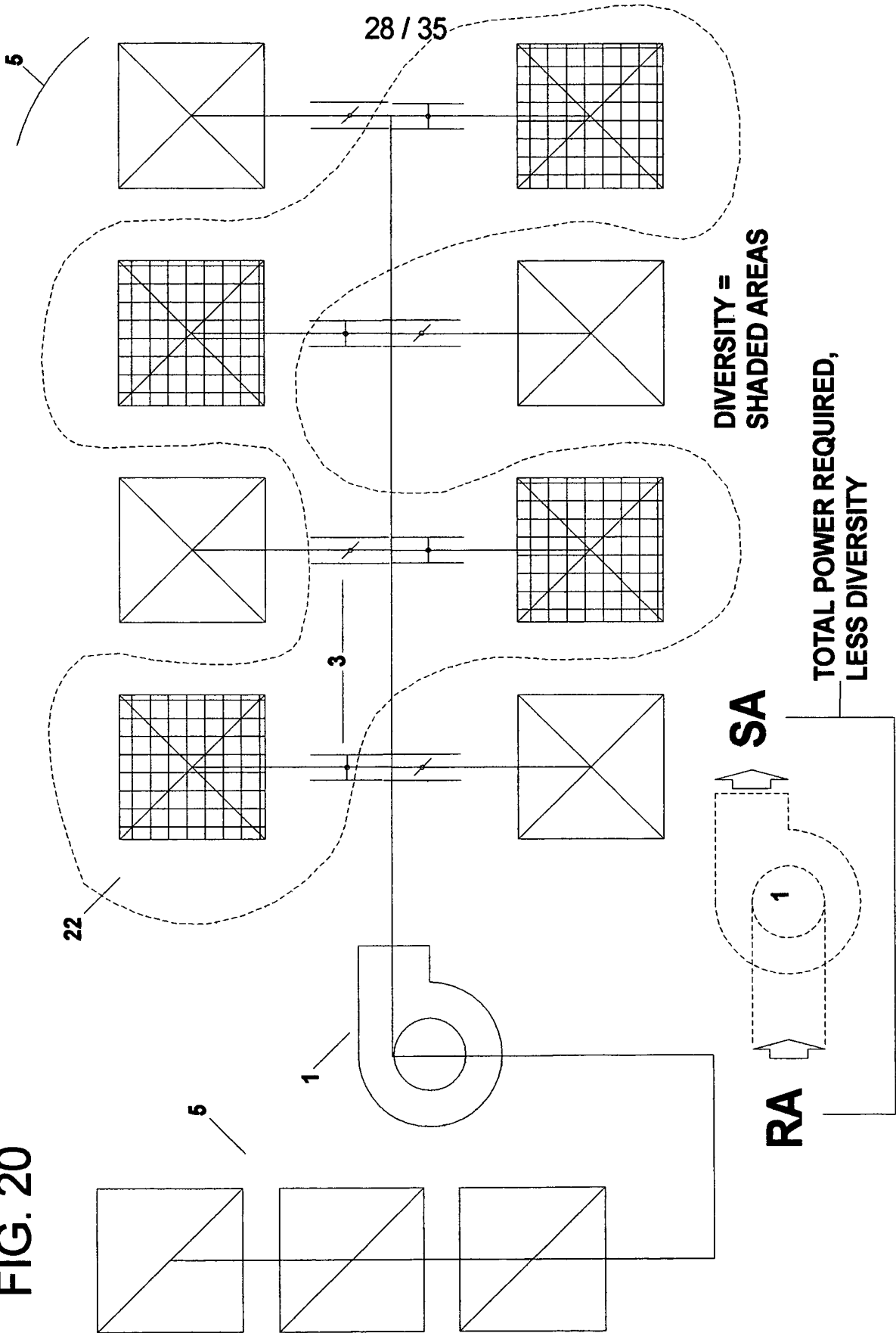
SHOWN HERE, A CORRELATIVE EFFECT BETWEEN A TOTAL SYSTEM AND ITS SUB-BRANCH AS THE CHANGE IN ONE AFFECTS THE OTHER, EITHER ADVERSELY OR BENEFICIALLY. THE VECTORIAL ANALYSIS PROVIDES A "BARE BONES" DEPICTION OF EACH SPECIFIC CHANGE EFFECTED IN ONE OR THE OTHER SYSTEM. FOR EXAMPLE, THERE WAS AN X INCREASE IN BHP WHEN A DAMPER WAS CLOSED IN THE SUB-BRANCH.



SWITCH TO OR FROM MAIN VECTORIAL DISPLAY SCREEN REFER TO FIG. 9

SYSTEM DIVERSITY

FIG. 20



INDEPENDENT SYSTEM CURVES (PRESSURE / HEAD)

